

WHAT IS CLAIMED IS:

1. An apparatus for removing a shade component from an image, comprising:

calculating section for performing principle component analysis on a set of face images having various types of shades to generate an eigen space;

storing section for storing the eigen space generated by said calculating section;

input section for receiving as an input a new face image;

projecting section for projecting the face image input through said input section to the eigen space stored in said storing section; and

producing section for producing a face image with shade component removed, based on the face image input through said input section and the image projected by said projecting section to the eigen space.

2. The apparatus for removing a shade component from an image according to claim 1, wherein

said calculating section includes

face component extracting section for extracting shape of each portion of each of the face images;

mean shape calculating section for calculating a mean shape for the set of said face images;

mean shape transforming section for transforming each face image to the calculated mean shape; and

principle component analyzing section for performing principle component analysis on the face images transformed to the mean shape to calculate eigen vectors to be base vectors of the eigen space.

3. The apparatus for removing a shade component from an image according to claim 2, wherein

said projecting section includes

face component extracting section for extracting shape of each

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5 portion of the input face image;
mean shape transforming section for transforming the input face
image to the mean shape calculated by said calculating section; and
eigen vector projecting section for projecting the face image that has
been transformed to said mean shape to said eigen space.

4. The apparatus for removing a shade component from an image
according to claim 3, wherein
said producing section calculates a difference component between the
image projected to said eigen space and an image with shade component
5 removed projected to said eigen space, and subtracts the difference
component from the face image input through the input section, so as to
produce a face image with the shade component removed.

5. The apparatus for removing a shade component from an image
according to claim 4, wherein
first to third or fourth components of the image projected to said
eigen space represent an image influenced by the shade component.

6. The apparatus for removing a shade component from an image
according to claim 4, further comprising
inverse transforming section for recovering shape of the face image
produced by said producing section from the mean shape to a shape of the
5 original face image.

7. An apparatus for removing a shade component from an image,
comprising:
calculating means for performing statistical processing on a set of
images having various types of shades, for calculating a prescribed image
5 space;
storing means for storing the image space calculated by said
calculating means;
input means for receiving as an input a new image;

10 projecting means projecting the image input through said input
means to the image space stored in said storing means; and
producing means for producing an image with shade component
removed, based on the image input through said input means and the
image projected to the image space by said projecting means.

8. The apparatus for removing a shade component from an image
according to claim 7, wherein the images having various types of shades
included in said set and the image input through said input means
represent subjects of the same type.

9. A method of removing a shade component from an image,
comprising the steps of:

performing principle component analysis on a plurality of face
images having various types of shades,

5 said step of performing principle component analysis including the
step of calculating eigen vectors and eigen values using eigen space method,
regarding pixel values of face images as vectors;

forming a dictionary space having said calculated eigen vectors as
base vectors;

10 forming a shade component removed space having a lower order
component obtained by the step of performing principle component analysis
as a base vector;

generating a dictionary image by applying a face image, from which
shade component is to be removed, to said dictionary space;

15 generating a removal image by applying said face image, from which
shade component is to be removed, to said shade component removed space;
and

20 subtracting difference between said dictionary image and said
removal image from said face image from which shade component is to be
removed, to generate a face image with the shade component removed.

10. The method of removing a shade component from an image

according to claim 9, wherein

said plurality of face images having various types of shades are
images transformed to mean shapes obtained by averaging shapes of a
5 plurality of original face images;

said face image from which shade component is to be removed is an
image transformed to said mean shape;

said method further comprising the step of

performing inverse transformation of said transformation on the face
10 image with the shade component removed, so as to recover the shape of the
original face image from said face image with the shade component
removed.